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Economic Trends

Dairy products

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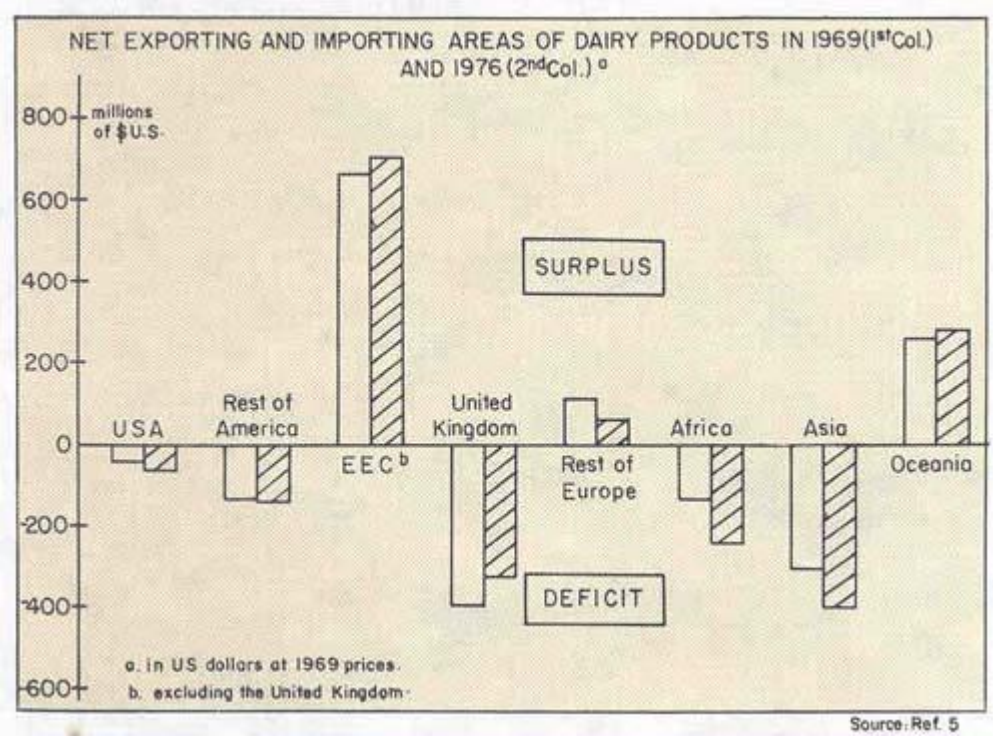
The world market for dairy products

Sixty per cent of world trade in dairy products consists of butter and cheese, while the rest involves fresh, powdered and condensed milk. However, fresh milk represents less than 5% of the total value of imports and exports. Trade in dairy produce involves approx. 10% of the world output of milk, or probably barely more than 6% if trade between EEC countries is subtracted. It is dominated by the European countries, especially those of the EEC, and by the lands of the Southwest Pacific (particularly New Zealand). Trade in butter and cheese mainly occurs between developed nations, the main buyers being the UK and the USA, and more recently a number of Asian countries such as Japan and the oil states. Milk exports, on the other hand, are primarily directed towards the developing countries of Asia, America and Africa. Leaving aside the small amount of exchanges in fresh milk, milk trade consists of two-thirds powdered and one-third condensed. In 1976 African countries absorbed 16% of that trade; their purchases primarily consist of condensed milk, which in 1976 represented over 55% of African milk imports and 43% of overall world trade in this commodity.

The growing influence of the EEC

THE EEC policy over dairy products is intended to isolate the domestic market in member countries from the world market through a system of import levies and restitutions for exports, while providing support for prices paid to producers in order to protect their incomes. The policy has led to a faster growth rate for the milk production of member countries than for their consumption of dairy products, which is held back by the changing habits of consumers and probably also by the relatively high level of domestic prices. Various external factors have also contributed to the development of milk output, notably the EEC policy of support for veal and beef production, which is often associated with that of milk.

Milk surpluses are turned into butter and skimmed milk powder which are then resold to the EEC intervention centres at rates which make adequate allowance for producer prices. Similarly, purchases of skimmed milk (fresh or powdered) for livestock feeds are subsidized. In 1978,

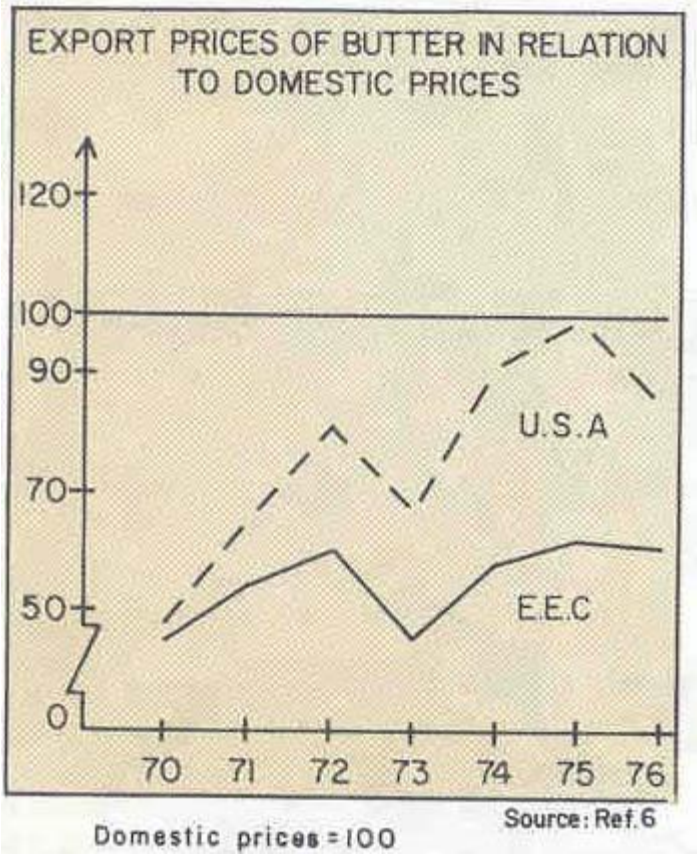


EEC stocks of butter averaged 320,000 t.; stocks of skimmed milk stood at 830,000 t., a lower level than in preceding years, owing to exports at low prices, more intensive utilization of powdered milk by member countries in the manufacture of livestock feeds, and to an increase in food aid to developing countries.

By forcing producers and intervention centres to seek ever more substantial outlets outside the Common Market, the production policy of the EEC has helped member countries to strengthen their position on the world market. Leaving aside Great Britain, whose membership of the EEC is recent and whose trade in dairy products for the time being remains subject to special arrangements owing to her close links with New Zealand, net EEC exports (at current prices) have moved forward from 1,350 million dollars in 1969 (35% of the world market) to 3,400 millions in 1976 (48% of the world market)[1]. Over the same period the share of New Zealand has fallen from 20 to 12%.

1. During 1976 the EEC paid out more than 1,500 million dollars in restitutions. Total dairy expenditure by the Guarantee Section of the European Agricultural Guidance and Guarantee Fund (EAGGF) amounted to nearly 4,000 million dollars.

The release of these surpluses onto a market of limited size contributes to the depressed level of export prices, in particular those of butter and skimmed milk powder. The unit value of butter exports is usually much below prices paid on the domestic market of most producing countries, in particular the EEC. This situation seriously affects efficient, non-subsidized producer countries such as New Zealand.



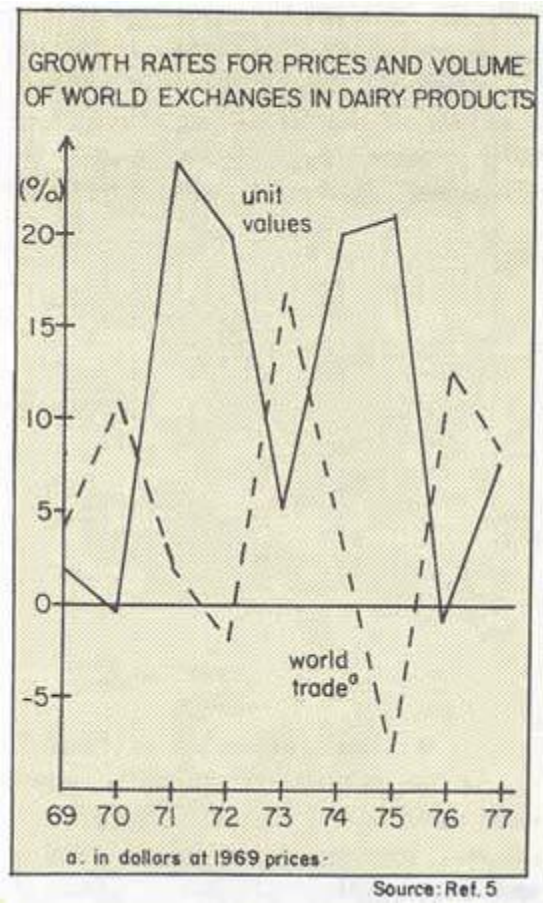
Trade volume and price trends

Between 1970 and 1977, producer milk and dairy product prices, when converted into American dollars at official rates of exchange, more than doubled in the member countries of the European Community, the average annual increase being 10%. Over the same period they increased by 8% per year in the United States, by 6% in Australia, and by 8.5% in New Zealand (15% in 1978).

Although they remained constantly depressed by comparison with domestic prices in the big European producer countries, export prices (unit values) almost doubled between 1970 and 1976 (10% per annum). Their progress has nevertheless been irregular, involving price leaps of 50% in 1971 and 1972 and 40% in 1974 and 1975 which have on each occasion led to a considerable slow-down in the volume of trade, which fluctuates in inverse ratio to prices. In 1976, a general decline in export prices set in, affecting powdered milk and butter in particular. The volume of trade, which had slackened in 1975, rose again by 13% in 1976 as prices fell. In 1977 it moved forward again, but at a slower rate (8% in relation to 1976); the initial data for 1978, showing a 5% increase over the corresponding period of 1977, confirms the slow-down in trade volume.

The high level of milk prices within the European Community means that producers in member countries enjoy a relatively favourable milk/animal feeds price ratio, all the more so since a part of the latter, especially oilcakes, is imported. Moreover, the steep rise in EEC milk prices protected European producers, especially in countries with a strong currency, from the worst effects of the increase in world prices of livestock feeds during the 1973–74 crisis. In 1977–78

milk/animal feeds price ratios in several EEC countries were generally similar to those obtaining at the outset of the present decade, whereas in other milk producing countries they have tended to deteriorate.

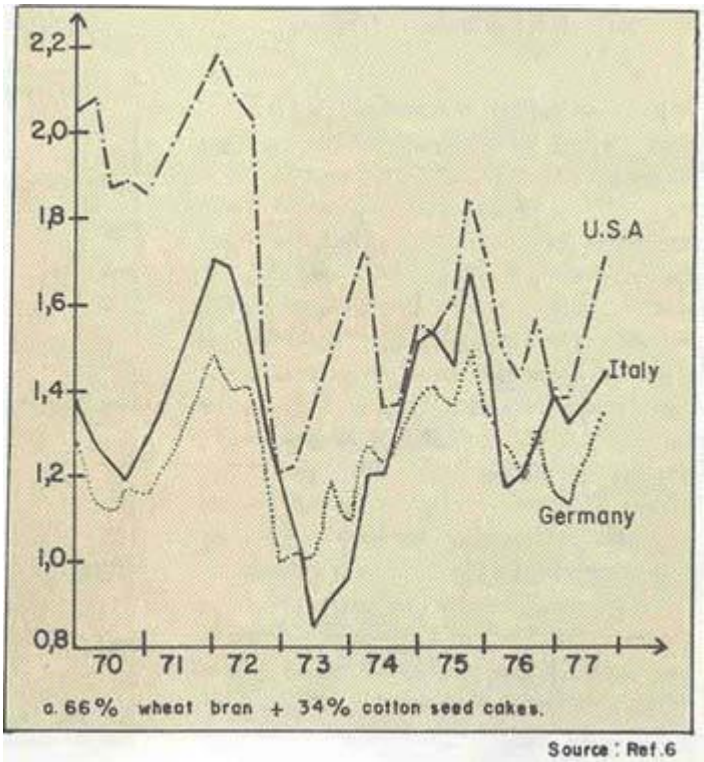


Market prospects

The instability and depressed level of export prices, and the long-term trend towards a continuous build-up in Community stocks, amounting in 1978 to the equivalent of 8 million litres of milk, i.e. 2.5% of world production and 10% of EEC output, reflect the structural imbalance of the world market for dairy produce. In order to reduce milk production the EEC has introduced a bonus system for non-delivery and aid for the conversion of dairy livestock, as well as a co-responsibility tax on dairy farmers whose output exceeds a certain level. But owing to a lack of political will these measures remain inadequate in relation to the scale of the problem.

Outside the EEC, the majority of producer countries wishing to support producer prices for milk have met the problem of surpluses by imposing production quotas.

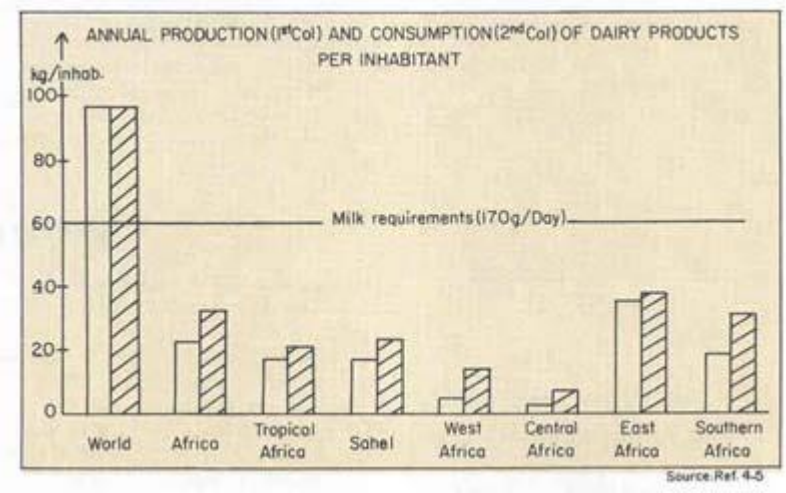
Milk/feedstuff[a] price ratio trend.



However, this solution was rejected by the exporters of New Zealand and the EEC, who in the course of the XXth. World Milk Congress held at Paris in June 1978 proposed the drawing up of an international agreement to control the supplies of dairy products and fix minimum export prices. Whatever the circumstances, the viability of such an agreement would depend throughout on the degree to which prices adopted within the Community conform more closely to main market trends. Where appropriate the adjustments necessary could take the form of direct income payments to small-scale producers. In other words, the entire policy so far pursued by the EEC should be reversed.

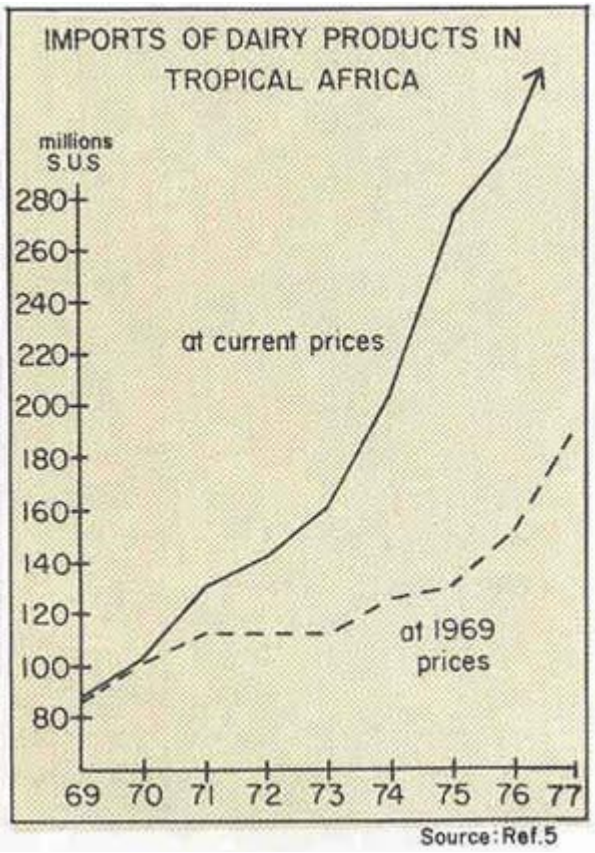
Milk supply problems in Tropical Africa

Except for the areas in which livestock production systems are nomadic, where milk constitutes a major source of nourishment for herdsmen, the production and consumption of milk products in tropical Africa remain at a relatively low level, especially in the humid areas of Central and West Africa. The development of urban consumer patterns, and the concern of governments, fostered by the international community, to improve the protein intake of African populations, are conducive to a gradual alteration of this situation. Imports of dairy products are on the increase ;and a growing number of projects have been launched to promote the development of local dairy industries.



Trade deficit

The countries of tropical Africa have a large deficit in dairy products. Their imports (over $ US 350 millions in 1977, 290 millions of which consisted of fresh, powdered or condensed milk) represent approximately 5% of overall world trade in dairy products and 11% of world trade in milk. They have shown rapid progress (19% per year between 1969 and 1977). This upward trend is due in part to the increase in prices, which have climbed steadily by 8.5% per year throughout this period of general inflation, a rate in line with the general increase for products exported and imported by African countries. The volume increase has therefore been around 10% p.a.; in fact, butter imports rose by 4.5% p.a. and there was a stagnating trend for cheese, while milk imports grew by an annual 11%.



Imports of dairy products form on average 1.5% of the total imports for the countries concerned, and some 14% of their food imports. Every country except for Kenya shows a deficit, even those exporting meat such as the Sahelian countries, Somalia, Ethiopia, Madagascar etc. The extent of their dairy imports is broadly the equivalent of one dollar per inhabitant, but nevertheless varies between different countries, Ivory Coast, Gabon, Mauritius and Reunion importing six to ten times the average, whereas Sudanese imports remain at a low level of four cents per capita in 1976.

A redistribution of the figures on a regional basis shows that West Africa attracts the majority of this trade (58%), Nigeria alone accounting for one third of it. The preeminent position of West Africa, where milk production in coastal areas is negligible, is explained partly by the size of its population and partly by the extent of its imports per inhabitant, which are three times higher than the average for the other countries. The figures for milk imports on a per inhabitant basis[1] are amongst the highest for tropical Africa, while two thirds of imports consist of condensed milk, which, at 30 cents per litre of milk equivalent in 1976,has an import unit value double that of powdered milk (14 cents). In Central Africa the majority of imports also consist of condensed milk, but the quantities imported are low. In Southern Africa, on the other hand, the amount of milk imported per inhabitant is almost as large as in West Africa, but it consists for the most part of powdered milk, and therefore has a lower value. Imports in East Africa are low, and Kenya is in fact an exporter, notably to Uganda and Tanzania.

1. Expressed in litres of milk equivalent on the basis of 2.6 litres of fresh milk per kilo condensed milk, 8 litres per kilo of powdered milk, 22 litres per kilo of butter and 9 litres per kilo of cheese.

Imports of dairy products in Tropical Africa in 1976.

Areas	Imports of dairy products		Per capita imports of condensed dry, liquid milk		
	Totals ($millions)	Per capita (U.S. cents)	Value (U.S. cents)	Volume (kg/milk equiv.)	Unit value[a](U.S. cents)
Sahel	20,3	90	80	5,1	15,6
West Africa	178,6	176	156	6,0	26,0
Central Africa	30,1	75	60	2,6	23,0
East Africa	23,3	30	26	1,9	13,7
Southern Africa	52,0	116	85	6,2	13,7
Total	304,0	106	90	4,3	21,0
a. Per kg milk-equivalent.					Source: Ref. 5

Dairy development constraints

These import flows illustrate the inadequacy of domestic milk supplies in tropical Africa. Quite apart from the virtual non-existence of cattle in the humid zones of Central and West Africa, the situation is explained by the very low productivity of indigenous animals in the cattle raising areas. The yield of both zebu and taurine cows, which together form virtually the entire herd, rarely exceeds 200 l. per lactation for human consumption, becoming negligible during the dry season when feed resources are inadequate. In favourable conditions imported dairy breeds such as Friesian-Holstein, Jersey etc.., produce 3000 l. per lactation. The performances of breeds resulting from crosses with dairy breeds are also vastly superior to those of local cattle, though nonetheless dependent on feeding and health conditions.

The introduction of improved breeds does, however, present various problems. In areas where transhumant and nomadic herding systems are practised, the aridity of the climate constitutes the major obstacle, since although indigenous cattle are low-producing they are also well adapted to a difficult environment, so that any efforts to seek improvements meet with bio-climatic constraints. In mixed farming areas, especially the highlands enjoying a relatively temperate climate where there is a definite potential for the development of dairy husbandry, the constraints are primarily those of nutrition and health, but also socio-economic as well.

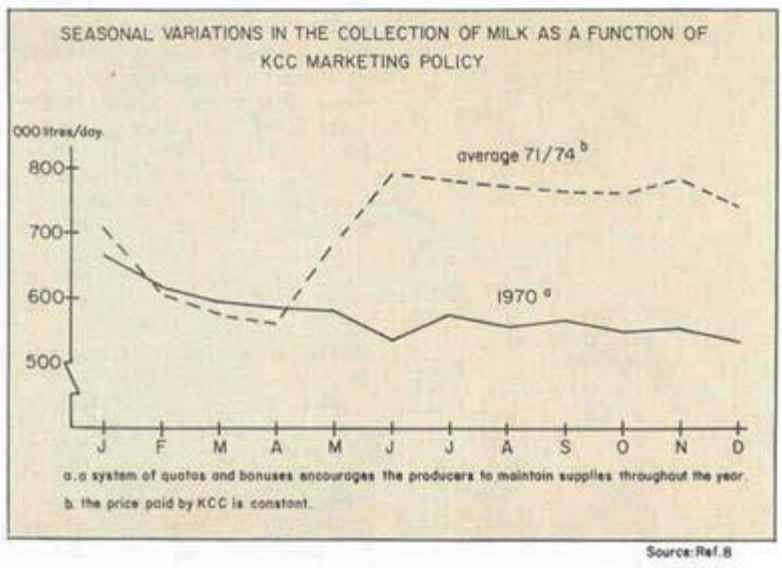
Farmers do not always possess cattle, and when they do the animals are raised primarily for draught purposes, seldom for meat and only very rarely for their milk. Furthermore, the practice of manuring is virtually non-existent, as also is that of a regulated ley system allowing room for fodder crops, a system which would simultaneously maintain soil fertility and resolve, at least in part, the problems of feeding cattle during the dry season. In short, dairy husbandry requires a far more sophisticated level of farm and herd management than that at present operated in the majority of production systems in these areas. Normally, even the minimum conditions for introducing improved breeds remain unfulfilled.

The marketing of milk, which is a particularly perishable product in hot countries, involves further difficulties. In the areas where transhumance is practised, the remoteness of production areas prohibits the transport of milk to urban markets by traditional means[1]. As a result, local production surpluses may occur, giving rise to a seasonal production of ghee and cheese which sometimes reaches a market further afield (as is the case in Somalia and Botswana for example), while milk supplies to urban centres are by no means guaranteed. In mixed farming areas the production of milk is for farm consumption, or else is exchanged locally to meet demand from relatively populous regions. Here again the supply of the large urban centres is not guaranteed by the areas of production. Instead, urban supplies rely on small-scale farmers who live on the outskirts of towns and raise a limited number of animals with a view to selling their milk at relatively high prices. Very often the product is inferior in quality, poorly conditioned, frequently adulterated and contaminated with bacteria. Generally speaking, most of the demand for milk is satisfied by imports, usually condensed or powdered milk and very occasionally in liquid form.

1. The marketing of the relatively small and seasonal milk production could, moreover, hardly be expanded because of calf nutritional needs, and hence also affects beef production.

Thus a number of constraints are acting in concert to frustrate the development of the dairy industry. These constraints are not independent. The introduction of improved livestock cannot be envisaged without a corresponding improvement in animal health, nutrition and farm management methods, for fear of a decline in yields to levels as low as those for indigenous cattle. Similarly, the lack of an effective marketing system threatens to deter producers from seeking to improve their production systems for want of outlets. Conversely, the creation of an institutionalized marketing system presupposes the installation of facilities (collection and distribution units, means of transport, processing plant, etc.), the profitability of which will remain a matter of chance as long as the market serviced is limited in size. The risk is all the greater if there is a traditional marketing channel operating at lower costs, since in this case the official system merely tends to absorb any available surplus after supply has been disposed of on the traditional market at the official price. Government price policies are therefore a crucial factor if the official system is to be guaranteed regular supplies, since the official price may either be lower than the local price, tending to deflect production onto the traditional market, or else it fails to make adequate allowance for seasonal variations in production, thus intensifying variations in the amounts of milk collected.

The development of a modern dairy industry under theses conditions requires an integrated programme dealing with all the various factors inhibiting the evolution of the production system. Since no industry relies solely on large-scale units, a fact which is particularly true of the dairy industry, whose development has always been linked historically with the small-scale agricultural enterprize, the process of development is bound to attribute a crucial role to small-scale farmers.



Further, any intervention should not merely include effective control of livestock diseases, genetic improvement programmes and the marketing of production increases, but should also transmit to African peasants the know-how which they need in order to begin to transform their management practices.

Development policies

Kenya, a country enjoying favourable ecological conditions and the benefits of long-standing experience, is the only country in tropical Africa to have experienced the implementation, so far successful, of a relatively well developed dairy industry. The dairy herd is estimated at about 500,000 heads of which over 40% are in the hands of small-scale owners. As part of an artificial insemination programme (AI) launched in cooperation with the Swedish Government, improved dairy cows are being introduced on farms which did not previously possess any, a policy which is making a further contribution to the growth of the national herd. The Kenya livestock authorities have made efforts to extend both the control of epizootic diseases and the health services available to small-scale owners, and at the same time an extension programme has been established, although its effectiveness has been somewhat called into question.

An official marketing system for the collection and distribution of milk has also been set up. It is managed by Kenya Cooperative Creameries (KCC), a parastatal body which has access to some 5,500 suppliers and collects the major share of production transmitted through the official channels. However, it is estimated that virtually all the milk produced by zebu cows, as well as half the overall production of the dairy herd as a whole, is consumed on the farm or else sold locally. Only a quarter of overall milk production is believed to reach the KCC market. However, this situation has not prevented Kenya from supplying all her urban centres, nor from exporting a proportion of her butter and milk products (fresh, condensed or powdered) each year. Exports amounted to 40,000 tonnes of milk equivalent in 1976, and an average of 100,000 tonnes in 1973 and 1974.

A growing number of countries are attempting to develop their production and/or marketing of milk. The International Programme for the Coordination of Dairy Development has been set up, enabling the active support of the international community to be brought to bear on efforts made

at the national level. Interventions are for the most part the responsibility of governments. However, in the ecologically favourable regions of East Africa (Tanzania and Ethiopia in particular), and even in West Africa (the Jos Plateau in Nigeria), a number of dairy farms have been initiated in the past by the private sector; most of them have since been brought under government control. Milk production plants (for condensed or liquid milk), using entirely imported materials such as milk powder and butter oil, have also been installed in areas where local production is either negligible (Southern Nigeria or Ghana) or else inadequate (Madagascar).

Governments direct their efforts towards various, different fields. They set up dairy farms (in Ghana, Nigeria and Tanzania) and breeding stations for exotic or improved strains, with a view to AI or direct distribution of heifers (in Ethiopia, Tanzania and Madagascar); they operate extension and animal health programmes, provide factories for the manufacture of animal feeds, and last but by no means least, they set up marketing facilities for the supply of liquid milk to urban centres.

These facilities provide on the one hand for the installation of fresh milk collection centres, and on the other for the processing, packaging and distribution of dairy products manufactured from local supplies, or else from imported powdered milk and butter oil or even local fats (e.g. groundnut). In the latter case the aim is to compensate for the inadequacy of local supplies by producing reconstituted milk, thus allowing better utilization of the installed capacity. The high fat content of local milk (around 5%) also enables it to be mixed with a proportion of skimmed milk to produce a product of normal fat content. In the poorest countries this aspect of the Government's activities receives aid from UNICEF and the World Food Programme in the form of free allocations of skimmed milk powder and butter oil. The aid is intended to allow the beneficiary countries to set up a marketing structure, while providing governments with the extra time in which to develop production, and dairy plants with a period in which to consolidate their financial positions and thus pay for their own supplies of powdered milk.

The results achieved appear tenuous. As regards production, the breeding of dairy cows has more often than not remained at the experimental stage, involving a limited number of animals, either of exotic breeds or else improved by cross-breeding, raised on pilot farms. At the most there are only a few semi-commercial farms aiming to supply the large cities (in Ghana and Nigeria, for example), but their size is limited by comparison with demand. A few countries, such as Madagascar and Tanzania, which enjoy favourable ecological conditions and the benefit of a certain amount of experience in the genetic improvement of livestock, possess an improved dairy herd, but the performances of such herds are mediocre. The yield of improved milkers is estimated at 1000 l. per lactation in Madagascar and 2200 l. in Tanzania, where one third of the improved dairy herd belongs to large-scale farms in the Dar-es Salaam and Arusha areas (these were run by private farmers but have now been taken over by the public sector), the remainder being owned by smallholders on the slopes of Kilimanjaro and Mount Meru, and in the Mare region. The dairy development project operating in Ethiopia, where there were already several dairy farms in the Addis Ababa and Asmara regions, has enabled the further extension of dairy herd development within this country also.

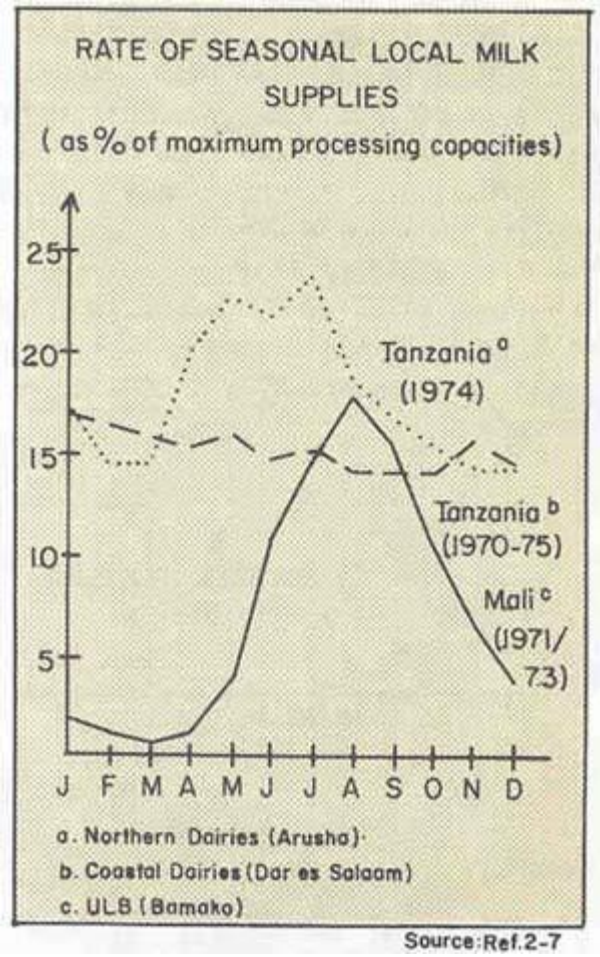
Local milk supply to dairies in Tropical Africa.

Countries	Urban market serviced	Processing capacity[a]	Estimated rate of local milk supplies[b]	Principal suppliers
Ethiopia	Addis Ababa	35,000	50% (1976)	Farms–small holders

Tanzania	Dar es Salaam Arusha Mare	50,000 40,000 50,000	15 % (1970–74) 23% (1970–74) 28% (1975)	State farms Farms—smallholders Small holders
Somalia	Mogadiscio	20,000	40% (1971–75)	" "
Malagasy	Tananarive[c]	10,000	10 % (1972)	" "
Nigeria[d]	Lagos, Ibadan Ilorin, Kaduna Kano, Minna Maidugurri	] 20,000	5% (1970–74)	Farms—few small holders
Ghana	Accra	24,000[e]	2% 1970–74)	State farms
Mali	Bamako	10,000	8% (1974–76)	Small holders

Source: Ref. 2, 3, 7
a. in litres/day
b. as a percentage of processing capacities
c. the dairy was closed in 1973/74
d. seven parastatal dairies set up to supply the market with liquid milk
e. liquid milk and milk chocolate plant (mostly recombined)

As regards marketing, the collection of fresh, local milk supplies rarely enables even half the processing capacity installed under dairy development projects to be taken up. The supply level of local milk ranges from 10% in Somalia to 25% in Tanzania, but frequently falls below 10% (in Mali, Madagascar, Nigeria and Ghana). Moreover, because of price differences between official and traditional markets, the supply is irregular, either varying from one year to the next, or else falling off during the dry season. In Mali, for example, it usually falls to below one hundred litres a day during the dry season, whereas the processing capacity is 10,000 litres; during 1977, virtually no local milk was even collected by the official channel in the Bamako area. Under these conditions, the collection of fresh milk becomes highly unprofitable. Moreover, dairies are also increasingly obliged to produce reconstituted milk in order to ensure rational utilization of their productive capacities; the production of reconstituted milk is now up to five or more times as great as that from local milk. In general, despite all the projects implemented, the supply of urban centres by organized marketing systems continues to rely directly or indirectly on improved products, while the operation of plants remains unsatisfactory.



Milk prices in Tropical Africa

Official prices paid to producers vary considerably from one country to the next. In 1975 they were fixed, on the basis of official exchange rates, at a maximum of 46 US cents per litre in Nigeria and a minimum of 11 cents per litre in Kenya (12 cents in Madagascar). In Nigeria the price varied between 17.5 and 46 cents, depending on the policy followed by the various States. On markets outside Africa, producer prices ranged from 10.3 cents in New Zealand to 20 cents in the US, and from 18 to 22 cents in the countries of the EEC. The unit value of world exports of fresh milk was estimated at 21 cents per litre.

The range of prices in Africa is clearly wider than on the world markets. However, official prices are for the most part lower than those of the traditional market, owing to the concern on the part of governments to supply the large towns at a reasonable price. The data necessary for a systematic comparison of the difference between official and traditional market prices is lacking. Nevertheless, the figures available show that this difference may at times be considerable. It is believed to fluctuate between parity, and double or even triple the official price in certain areas of West Africa (Ghana and Nigeria) where prices on the traditional market were estimated at 60 cents a litre in 1975. The difference was estimated to be 100% in Somalia, 50 to 100% in Mali (according to the season), and 60% in Tanzania; in these countries prices on the traditional market in 1975 were estimated at 50 cents, 28 cents and 35 cents per litre respectively. In a number of areas in Kenya covered by the AI programme, local prices are probably as much as

double those offered by KCC, and in several other areas they would be between 25 and 30% higher than official prices.

Comparison of prices paid to milk producers in Tropical Africa and the world in 1975–76.

		in U S cents/litre
Countries	Price on official market	Price on traditional market
Tropical Africa		
Ghana	27,2	62
Nigeria	17,5/46[a]	62
Senegal	–	66/80
Mall	16/20[b]	25/40[b]
Somalia	22	48/54[b]
Ethiopia	15/17 [b]	
Kenya	11	10/22[a]
Tanzania	20/24[a]	35
Malagasy	11/13 [b]	14/16[b]
World		
United States	19,8	
E.E.C	19,1 [c]	
N. Zealand	10,3	

a. Maximum and minimum prices paid in different areas.
b. Wet and dry season prices.
c. Average prices in member states.
Source: Ref. 2–3, 6–7

To sum up, in 1975 the price of milk in many African countries was two or three times higher than the average price on world markets. Since then the difference has certainly not been reduced, since milk prices have moved ahead faster in Africa than on the world market as a whole.

Analysis of producer price ratios as a means of comparing local production costs provides further evidence of the high costs of milk production in tropical Africa. Except in Kenya and Madagascar, where price ratios appear to be relatively favourable, the beef/milk price ratio is generally close to 2; the milk/cereals price ratio is probably generally higher than 2 and would far exceed this level in several countries of West Africa. These ratios indicate the poor profitability of milk production in the majority of African countries as compared with that of meat or cereals. Milk is in fact a luxury product largely beyond the reach of the poorest population groups, the production of which is scarcely viable economically under the production conditions at present prevailing in tropical Africa. The policy pursued by governments of increasing local supplies at relatively low prices is therefore not compatible with the present capacity of the

production system, and even less so to the extent that efforts to develop milk marketing facilities are not always accompanied by corresponding efforts to promote production. The result is an under-utilization of the installed capacity for collecting local milk supplies, and sometimes even of the plants for processing dairy products.

Milk prices in relation to other agricultural products in Tropical Africa.

Countries	Price ratio	
	Beef/milk	Milk/cereals
Tropical Africa[a]		
Ghana	2,4	8,3
Senegal	1,9	6,0
Nigeria	2,8	
Mali	1,8	4,5
Ethiopia	2,5	2,7
Tanzania	1,5	2,3
Malagasy	4,8	1,1
Kenya	5,4[b]	1,4[b]
World		
United States	7,0	2,0
Denmark	8,3	0,8
N. Zealand	6,0	0,8

a. Price of milk on traditional market
b. Price of milk on official market.
Source: Miscellaneous

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Milk production potential in the Highlands of East Africa

Given their temperate climate, the highlands of East Africa probably enjoy the greatest potential in tropical Africa for the development of dairy farming. However, with the exception of Kenya the area has a trade deficit in dairy products, while efforts to promote production often meet with setbacks, apparently owing to a sectorial approach which does not allow the overall complex of issues facing farmers to be viewed as a whole and dairy husbandry to give returns per unit area which are comparable to those of crops. In its Highland programme, now mainly concentrated in Ethiopia, ILCA is studying improved production systems, in which dairying is integrated into the farming system as a whole.

The Highlands of East Africa

The East African highlands, defined as 1,500 metres and more above sea level, lie between latitudes 18°N, and 10°S. and cover an area of over 780,000 km^2, i.e. 4/10ths of Ethiopia, Rwanda and Burundi, 1/5th of Kenya, and 1/8th of Tanzania. Their climate, which is generally temperate, varies according to their geographical position and elevation; rainfall increases with altitude, from East to West across the zone, and nearer the equator. Temperatures are warmer and more uniform within the equatorial belt, whereas frosts may occur above 2,800 metres in the sub-equatorial zones.

Consequently, the highlands of Tanzania, Kenya and South and Southwest Ethiopia are warmer and more humid than those of Central and Northern Ethiopia. Owing to their volcanic origin these different zones are also endowed with fertile soils. However, soil fertility is often depleted through erosion and human over-utilization.

Small, mixed farms combining crop and animal husbandry in various ways have developed in these zones. Traditional hoe cultivation systems with tea, coffee and cotton plantations, sometimes combined with cereal cropping, prevail in the regions with a longer rainy season, e.g. the equatorial zones of Kenya, Tanzania and Southwest Ethiopia. In Central and Northern Ethiopia, where the principal crops are cereals and pulses, the prevailing cultivation method is that of animal traction, These cereal/livestock production systems have a high potential in a large proportion of the Ethiopian highlands, although low-potential systems prevail in the degraded areas and the plateaux and escarpments which lie between areas of high and low altitude. They are generally oriented towards self-sufficiency, and animals are raised primarily for draught purposes and fuel production, and only secondarily for meat and milk. In many Kenyan smallholdings, on the other hand, animal husbandry is oriented towards milk production, which may provide as much as two thirds or more of farm income. Production is carried out under various systems, ranging from extensive to highly intensive zero grazing methods.

Owing to the temperate climate conditions and to their orientation towards mixed agriculture, these small farms should enjoy a real potential for the development of animal production, especially dairy husbandry. However, population growth with no corresponding increase in agricultural yields is leading to a growing pressure on arable land, which in turn results in a decline in animal production and in the deterioration of the ecosystem. Traditional practices are no longer able to meet the problems faced; their transformation is becoming imperative in order to maintain productivity and improve living standards, as also is the setting up of the infrastructure necessary for marketing increased and diversified production. It is with this process of transformation that ILCA's research is concerned, with the aim that the results

obtained should be applicable not only to the various systems directly involved, but also to other systems which resemble them.

Production systems in the ILCA study areas

At Debre Zeit, and more recently at Debre Berhan, both in Central Ethiopia, ILCA has established two research stations for high-potential cereals/livestock systems. The Debre Zeit station represents the lower highlands, where subequatorial plant species appear to be the best adapted, while Debre Berhan represents an upper zone, where temperate species are likely to be the most productive. Both centres, especially Debre Zeit, are relatively close to Addis Ababa and thus within reach of the country's largest urban market, thereby eliminating marketing constraints.

The type of enterprize found in these areas is the small mixed farm. In the Ada district surrounding Debre Zeit, average farm size, which was estimated to be 3.6 hectares in 1973, has been declining over the last few years, falling to only 2.5 hectares in 1978. The average farm size is 3.8 hectares in the area south of Debre Berhan. Farms are primarily oriented towards self-sufficiency. In the Debre Zeit area, all arable land is almost permanently cropped, fallow being by now virtually non-existent; the main crops raised are cereals (teff, wheat) and pulses (chick-peas, beans and lentils), for which the yields appear similar to those observed at national level. Acceptance of innovations is thought to be good.

The average number of livestock on farms is decreasing rapidly: from 5.8 LUs in 1973 to 3.8 in 1978. Apart from their use for draught purposes, animals are hardly ever integrated within the farming system; dung is never used as fertilizer but is rather burnt as fuel or sold, while forage cropping is virtually non-existent. Animals are fed on crop residues and pasture, which is either communal or privately owned.

Traditional farming in ILCA research areas in Ethiopia.

Main characteristics	Debre Zeit (Ada dist.)	Debre Berhan (South area)
Climate		
Altitude (mt.)	1600	2800
Annual rainf. (mm)	800	1200
Temperature (°c)	14–23	6–19
Farm Area		
Total (hectares)	2.5	3.3
Cropped (“)	2.3	1.3
Cropping pattern	yield Id use	yield Id use
Teff (7.2)[a]	7[b] | 41%	5[b] | 4%
Wheat (10.0)	6.5 | 16“	8 | 20“
Barley (10.0)	7.1 | 16“	9 | 46“
Chick peas (6.7)	6.2 | 7 “	– | –
Horse beans (10.6)	7.9 | –	8 | 23“
Others	– | 20“	| 1O“

Total	100	100
Livestock (L.U)[c]		
Oxen/bull	1.7	1.3
Cow	0.9	1.0
Other cattle	0.5	0. 9
Sheep–Goat	0.2	0.3
Equin–asin	0.5	1.0
Total	3.8	4.5
Animal feeds		
Feeding pattern	grazing—crop residues	
An. feed. avail. [d]	6.7	5.2
" " req. [d]	9.9	8.2
Ratio	68 %	63
Income pattern		
Auto–suff. ratio	52%	77%
Sources of income		
Crops	82%	80%
Livestock	18"	20"

a. notional yield 1975/78 in quintal/hectare.
b. all yield in quintal /hectare.
c. average number of L.U per farm.
d. in tonnes of dry matter.

According to a 1969/71 survey involving 12 farmers in the Ada district, the results of which preceded land reform, average gross farm income per year for an enterprize of 5.6 hectares with 6.2 LUs, i.e. larger than the typical farm size for the area, was around 900 Eth. birr.[1] During the same period, net farm income was estimated at about 660 Eth. birr, i.e. approximately 1,200 birr (or $US 600) on the basis of 1977/78 prices; 80% of this income was produced from crops and less than 20% from animal production. Almost half the total produce was marketed, 30% of sales arising from livestock products.

1. US $ 1 = Eth. birr 2.07

According to initial investigations, the pressure on land is believed to be lower on the farms in the area south of Debre Berhan, where the proportion of permanent pasture and fallow to cropped land is higher than at Debre Zeit. Barley replaces teff as the principal grain crop under a mixed production system even more largely oriented towards self-sufficiency. Exposure to innovation is significantly lower than in the Debre Zeit area where a considerable number of development agencies have already implemented schemes; only 5% of the farmers are reported to have used any improved technology during the past five years.

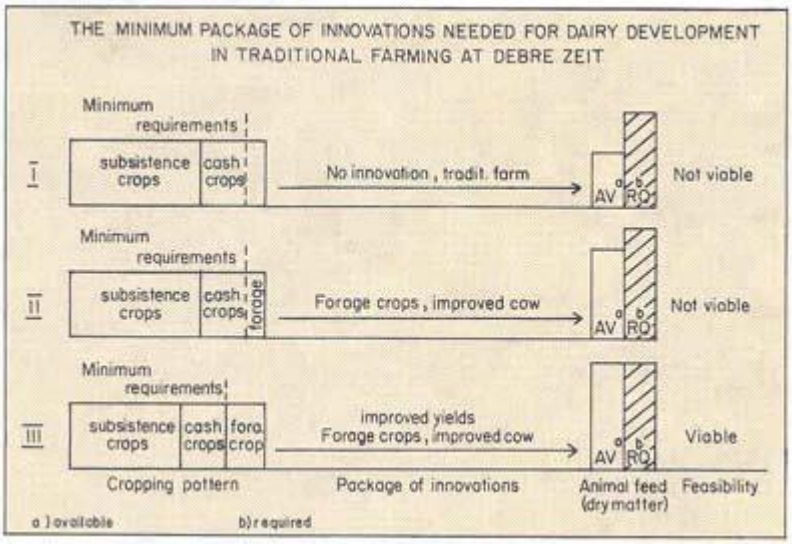
In both areas, as is typical in the highlands of East Africa generally, livestock productivity seems to be limited by inadequate nutrition and the low genetic potential of local cattle breeds. The

increased population pressure, combined with crop yields which are at present static, accentuates the need to allocate more land to grain cropping, thereby even further reducing animal feed availability; hence the decline in livestock numbers.

The ILCA research programme

Subsistence cropping will remain the most important feature of Ethiopian highland farming within the foreseeable future, and as a result improvement efforts should initially be directed towards increasing crop yields in order to reduce the area required for subsistence. On the spare land released by improved yields, forage crops can be introduced.

This concept underlies the package of innovations developed by ILCA and now being tested as the second phase of ILCA's research methodology on 20 farmers participating in the programme at the Debre Zeit station. The farmers implement the package at their own risk, while ILCA provides advice. The package includes the use of improved seeds and fertilizers, the cultivation of forage crops on arable land and the introduction of an improved dairy cow, combined with better management. The package proposed for Debre Berhan will be somewhat different in order to take local conditions into account. It will include the planting of forage on pasture and fallow land, without the need to consider a reduction in the area of grain crops. Moreover, in view of the potential for sheep raising in the area, improved sheep will be introduced with the improved dairy cow.



At the same time most innovative packages, some without the subsistence component, are being tried out on research farms under ILCA control and at ILCA's risk. Information is being collected on the input–output relationship of different farm components, on the secondary effects of certain innovations on aspects such as soil fertility, animal traction, consumption patterns etc., and on the effect of the package on farm income. This information should provide the basis not only for further research on the individual components but also for the planning of development schemes on a larger scale.

Moreover, it is hoped that by using simple simulation models the different components of the systems under study can be recombined to develop reliable packages for other regions,

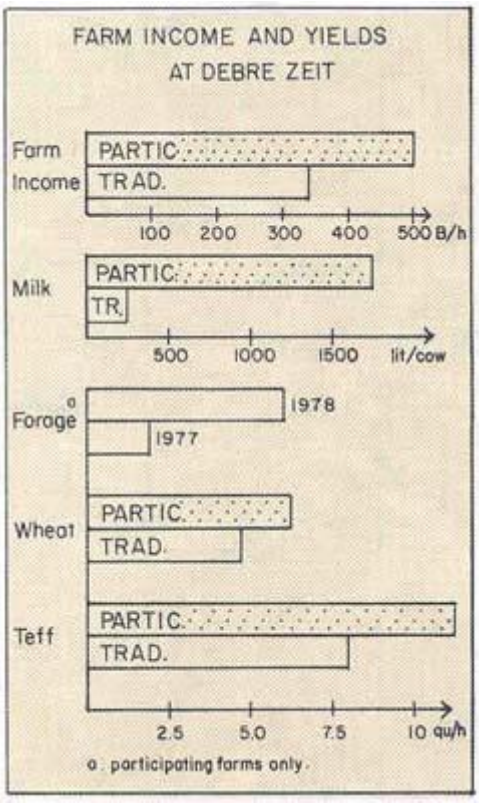
provided that sufficient baseline information on these regions is available, in addition to data on potential improved crops and forage yields.

The first results

It is still too early to draw up a complete report comparing the results of the participating and traditional farms monitored by ILCA. Nevertheless, the results obtained at Debre Zeit during the 1977 and 1978 cropping seasons are encouraging. The yields for cereals were higher in the participating farms, resulting in a per hectare family income which was 30% higher than that obtained on traditional farms (432 Eth. birr as against 331). The 1977 results for forage crops showed a slow rate of adaptation on the part of the farmers. However, the introduction of the improved dairy cow increased interest considerably, and in 1978 average production was approximately 6.7 tonnes of dry matter per hectare. Nevertheless labour and capital constraints became evident during silage making in 1977. Consequently, hay-making only was adopted for the 1978 season.

Production from the improved dairy cow in the 1978 season was 1,750 litres of milk/year. Annual yield per cow was approximately 470 birr. On a per hectare basis, dairying yields approximately 670 birr/year in family farm income. This compares favourably with the average family income from cropping under the improved system (birr 432 per hectare), and on the data obtained for these first years it appears that dairying can give similar returns to cropping.

To sum up, the average annual family income from the farms using the improved package was 502 birr/hectare, as against 331 from the traditional farms. However, owing to the lack of reliable data, these estimates do not include the income derived from non-improved livestock, which seems to be similar under both systems.



These results tend to indicate the benefit that agriculture in Ethiopia could derive from the development of dairy husbandry within small-scale enterprizes by improving the farm system as a whole. Nevertheless, they concern only an area whose degree of exposure to innovation is considered to be relatively higher than is typical for the Ethiopian highlands in general. In this respect, future results obtained by farmers participating at the Debre Berhan station will enable existing information on the rate of adoption of new technologies to be further complemented. Results so far are therefore highly tentative, and many problems remain to be solved before any more definite conclusions on the viability of the proposed systems can be drawn.